



## 299-E33-13 (A4840)

### Log Data Report

#### Borehole Information:

<b>Borehole:</b> 299-E33-13 (A4840)		<b>Site:</b> East of BY Cribbs			
<b>Coordinates</b> (WA State Plane)		<b>GWL (ft)<sup>1</sup>:</b> 230.4		<b>GWL Date:</b> 05/14/02	
<b>North</b>	<b>East</b>	<b>Drill Date</b>	<b>TOC<sup>2</sup> Elevation</b>	<b>Total Depth (ft)</b>	<b>Type</b>
137,584.4 m	573,706.5 m	Oct. 1953	192.55 m	235	Cable Tool

#### Casing Information:

<b>Casing Type</b>	<b>Stickup (ft)</b>	<b>Outer Diameter (in.)</b>	<b>Inside Diameter (in.)</b>	<b>Thickness (in.)</b>	<b>Top (ft)</b>	<b>Bottom (ft)</b>
Steel welded	2.45	8.625	8.0	0.3125	2.45	237.5
Steel welded	2.25	4.5	4.0	0.25	2.25	209

#### Borehole Notes:

The logging engineer measured the pipe stickup at the borehole using a steel tape. Calipers were used to measure casing outside diameter and casing wall thickness. A steel tape was used to measure the 4-in. casing. Zero reference is the top of the 8-in. casing stickup. One reference point survey "X" is located on top of the casing stickup. Top of casing stickup is cut evenly. On the ground surface surrounding the casing is a 4-ft x 4-ft x 6-in. concrete pad. Grout is visible in the annulus space between the two casings at the ground surface. HWIS<sup>3</sup> is the source of the TOC elevation and coordinates. Total depth (ground level reference) and casing bottom (TOC reference) are reported from information provided in Ledgerwood (1993). Drill date and drill depth are as reported in Chamness and Merz (1993).

The borehole was not swabbed before logging. This groundwater monitoring well is routinely sampled, and casing contamination has never been reported. On 05/14/02, before logging, Duratek Federal Services ran the straightness gauge in the borehole.

In 1992, the borehole was remediated (Ledgerwood 1993). The 8-in. casing was perforated, and a 4-in. liner was set to about 209 ft (TOC reference). Bentonite pellets were placed from 206 to 207 ft (TOC reference), and sand was placed above the bentonite pellets to about 203 ft (TOC reference). The annulus between the 4-in. and 8-in. casings was grouted.

#### Logging Equipment Information:

<b>Logging System:</b> Gamma 2A		<b>Type:</b> SGLS (35%)	
<b>Calibration Date:</b> 11/01		<b>Calibration Reference:</b> GJO-2002-286-TAR	
		<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0	

#### Spectral Gamma Logging System (SGLS) Log Run Information:

<b>Log Run</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Repeat</b>
Date	05/13/02	05/14/02	05/15/02	05/15/02	05/16/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	3.0	140.0	236.0	210.0	234.0

Log Run	1	2	3	4	Repeat
Finish Depth (ft)	38.0	37.0	207.0	139.0	210.0
Count Time (sec)	200	200	100	200	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A <sup>4</sup>	N/A	N/A	N/A	N/A
MSA Interval (ft)	1.0	1.0	0.5	1.0	0.5
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	BA148CAB	BA150CAB	BA151CAB	BA151CCAB	BA152CAB
Start File	BA149000	BA150000	BA151000	BA151059	BA152000
Finish File	BA149035	BA150103	BA151058	BA151130	BA152048
Post-Verification	BA149CAA	BA150CAA	BA151CAA	BA151CAA	BA153CAA
Depth Return Error (in.)	0	0	N/A	+0.5	0
Comments	No fine-gain adjustment.	Fine-gain adjustment note below.	No fine-gain adjustment.	Fine-gain adjustment note below.	Repeat section. No fine-gain adjustment.

### **Logging Operation Notes:**

Zero reference is the top of the 8-in. casing.

Pre- and post-survey verification measurements used the Amersham KUT verifier with serial number 082.

Logging was performed without a centralizer installed on the sonde. During SGLS logging, fine-gain adjustments were made to maintain the 1460-keV (<sup>40</sup>K) photopeak at a pre-described channel. During logging run 2, 05/14/02, a fine-gain adjustment was made after file BA15083. During logging run 4, 05/15/02, fine-gain adjustments were made after files BA151060, -089, and -111.

### **Analysis Notes:**

<b>Analyst:</b>	Sobczyk	<b>Date:</b>	05/20/02	<b>Reference:</b>	MAC-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verification spectra were collected at the beginning and end of each day. The recorded peak counts per second (cps) for the post-run verification spectrum at the 609-keV peak, 1461-keV peak, and 2615-keV peak differed by 1 to 3 percent when compared to the pre-run verification spectrum. The verification spectra were all within the control limits. The post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC Supervisor.

Spectra were processed in batch mode using APTEC Supervisor to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL (source file: G2ANov01.xls), using parameters determined from analysis of calibration data collected in November 2001. Zero reference is the top of the 8-in. casing. On the basis of the logging engineer's measurements and Ledgerwood (1993), the casing configuration was assumed to be one string of 8-in. casing with a thickness of 0.3125 in. from 0 to total logged depth and one string of 4-in. casing with a thickness of 0.25 in. from 0 to 209 ft. When the casings overlap, the assumed casing thickness was the sum of the individual casing strings. A water correction was applied below 230.4 ft. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

## **Log Plot Notes:**

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides ( $^{40}\text{K}$ ,  $^{238}\text{U}$ , and  $^{232}\text{Th}$ ), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. In addition, comparison log plots of man-made radionuclides and total gamma are provided to compare the data collected by Westinghouse Hanford Company's (WHC's) Radionuclide Logging System (RLS) and Waste Management Federal Services Northwest's (WMFS-NW's) RLS with SGLS data. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The  $^{214}\text{Bi}$  peak at 609 keV was used to determine the naturally occurring  $^{238}\text{U}$  concentrations on the combination plot rather than the  $^{214}\text{Bi}$  peak at 1764 keV because it generally exhibited slightly higher net counts.

## **Results and Interpretations:**

$^{60}\text{Co}$  was detected in three zones in this borehole.  $^{60}\text{Co}$  was detected at activities near the MDL (0.1 pCi/g) at 101 and 102 ft.  $^{60}\text{Co}$  was detected at activities that ranged from 0.1 to 0.4 pCi/g between 156 and 161 ft.  $^{60}\text{Co}$  was detected in the interval from 218.5 to 236 ft.  $^{60}\text{Co}$  concentrations increase from about 0.1 pCi/g at 218.5 ft to about 7.5 pCi/g at the bottom of the hole (236-ft log depth).  $^{60}\text{Co}$  was detected below the last reported groundwater depth (230.4 ft). At log depths 115, 118, and 165 ft,  $^{60}\text{Co}$  was detected at activities near the MDL.

$^{137}\text{Cs}$  contamination was detected near the ground surface and in the bottom 32 ft of the borehole. A zone of  $^{137}\text{Cs}$  contamination was detected near the ground surface (log depth 4.0 through 49 ft) with activities ranging from 0.2 to 6.7 pCi/g. At log depths 57 and 70 ft,  $^{137}\text{Cs}$  was detected at activities near the MDL (0.3 pCi/g).  $^{137}\text{Cs}$  activities ranged from 0.3 to 0.5 pCi/g between 205 and 207.5 ft, which corresponds with the interval containing bentonite pellets.  $^{137}\text{Cs}$  activities ranged from 0.3 to 17.9 pCi/g between 212.5 and 229 ft. Near the bottom of the borehole (235 to 236 ft),  $^{137}\text{Cs}$  was detected with activities ranging from 0.8 to 8.0 pCi/g.

Due to the method of well completion, changes in the KUT logs that can be attributed to changes in stratigraphy are difficult to discern. The relatively high KUT values from 205 to 207 ft correspond with an interval containing bentonite pellets. The reported top of basalt at about 235 ft (Ledgerwood 1993) is not readily apparent.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for both the man-made and naturally occurring radionuclides. The 1173-keV repeat log detected  $^{60}\text{Co}$  at activities near the MDL from 217.5 to 220.5 ft while the original log run did not detect  $^{60}\text{Co}$  in this interval based on the 1173-keV photopeak.

Comparison log plots of data collected in 1992 by WHC, in 1997 by WMFS-NW, and in 2002 by MACTEC-ERS are included. The 1997 and 1992 concentration data for  $^{60}\text{Co}$  and  $^{137}\text{Cs}$  are decayed to the date of the SGLS logging event in May 2002. The SGLS and 1992 RLS logs appear to use a different depth reference, and the 1992 log was shifted from a ground level reference to a TOC reference. In 1992, the borehole was logged by WHC before the well was remediated. Thus, the higher  $^{137}\text{Cs}$  concentrations detected above 60 ft by the WHC RLS are due to the fact that the addition of grout and a string of 4-in. casing shielded the later logging from the formation. Similarly, slight decreases in apparent  $^{60}\text{Co}$  concentrations in the intervals between about 99 and 127 ft and 154 and 156 ft are observed. On the 1997 and 2002 logs, the apparent  $^{60}\text{Co}$  concentrations are lower than that predicted by decay alone when compared to the 1992 log. Since 1992,  $^{137}\text{Cs}$  activities appear to have increased between 205 and 207.5 ft, which corresponds with the interval containing bentonite pellets. In 1992, the bottom 2 ft of the borehole were not logged. These changes in contaminant profile over the last 10 years may have occurred in association with the well remediation in 1992.

Gross gamma profiles from Additon et al. (1978) (attached) indicate that the sediments surrounding this borehole contained significant amounts of gamma-emitting contamination in the late 1950s. The profile from 5/5/59 detected gamma activity above background in the intervals from 82 to 92 ft (25 to 28 m), 138 to 161 ft (42 to 49 m), and below 203 ft (62 m). The SGLS detected <sup>60</sup>Co at 101 and 102 ft, from 156 to 161 ft, and from 217.5 ft to the bottom of the borehole (236 ft), and these contaminated intervals appear to occur lower in the borehole than in 1959.

Because of this borehole's close proximity to the 241-BY-103 tank leak and the BY cribs, it is recommended that this borehole is logged periodically to verify that the changes observed in contaminant profile over the last 10 years have occurred in association with the well remediation in 1992. The interval from 80 ft to total depth should be logged again in 5 years with the SGLS.

## **References:**

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Wells*, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, UC-903, Pacific Northwest Laboratory, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

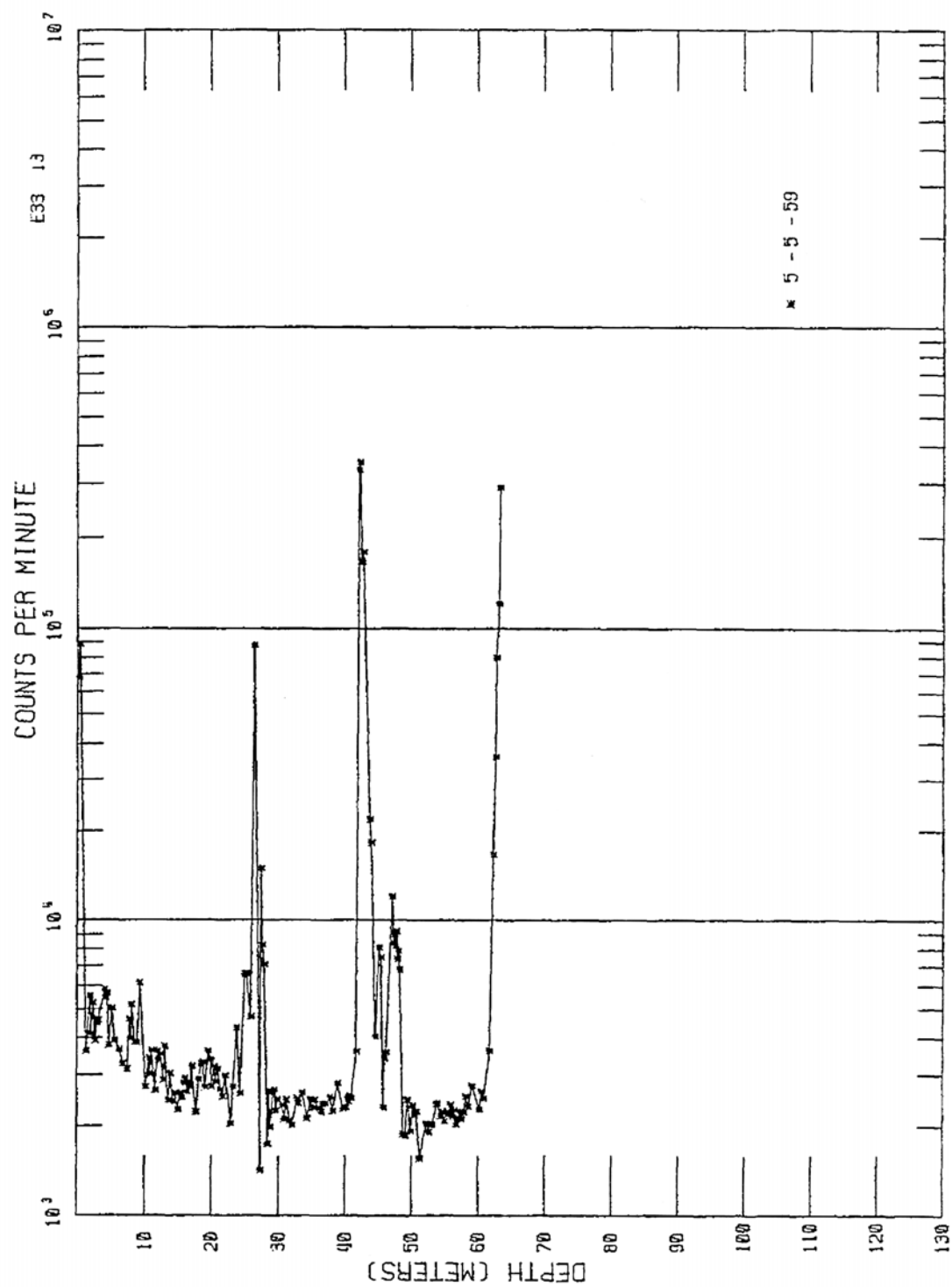
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<sup>1</sup> GWL – groundwater level

<sup>2</sup> TOC – top of casing

<sup>3</sup> HWIS – Hanford Well Information System

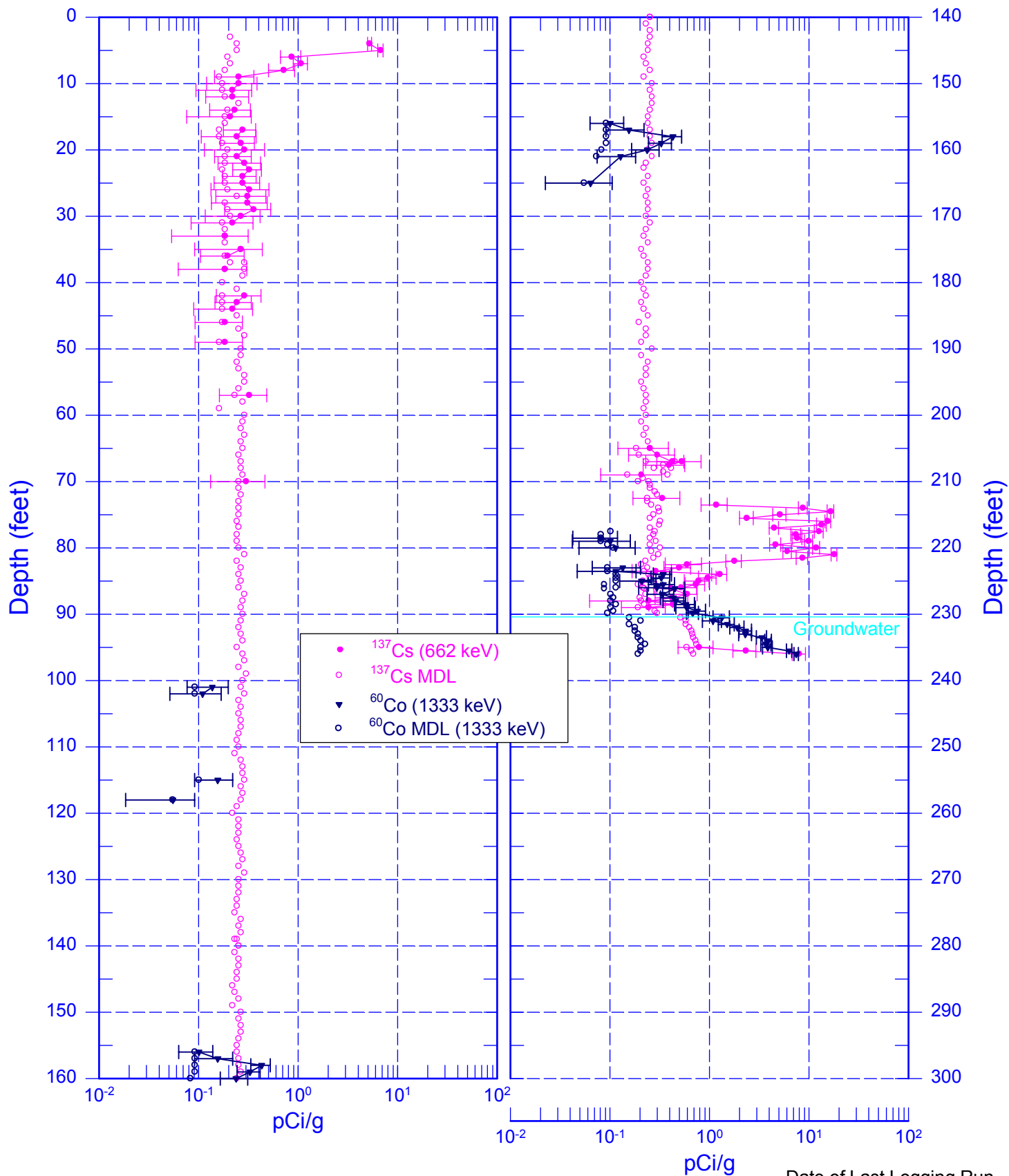
<sup>4</sup> N/A – not applicable



from Additon (1978)

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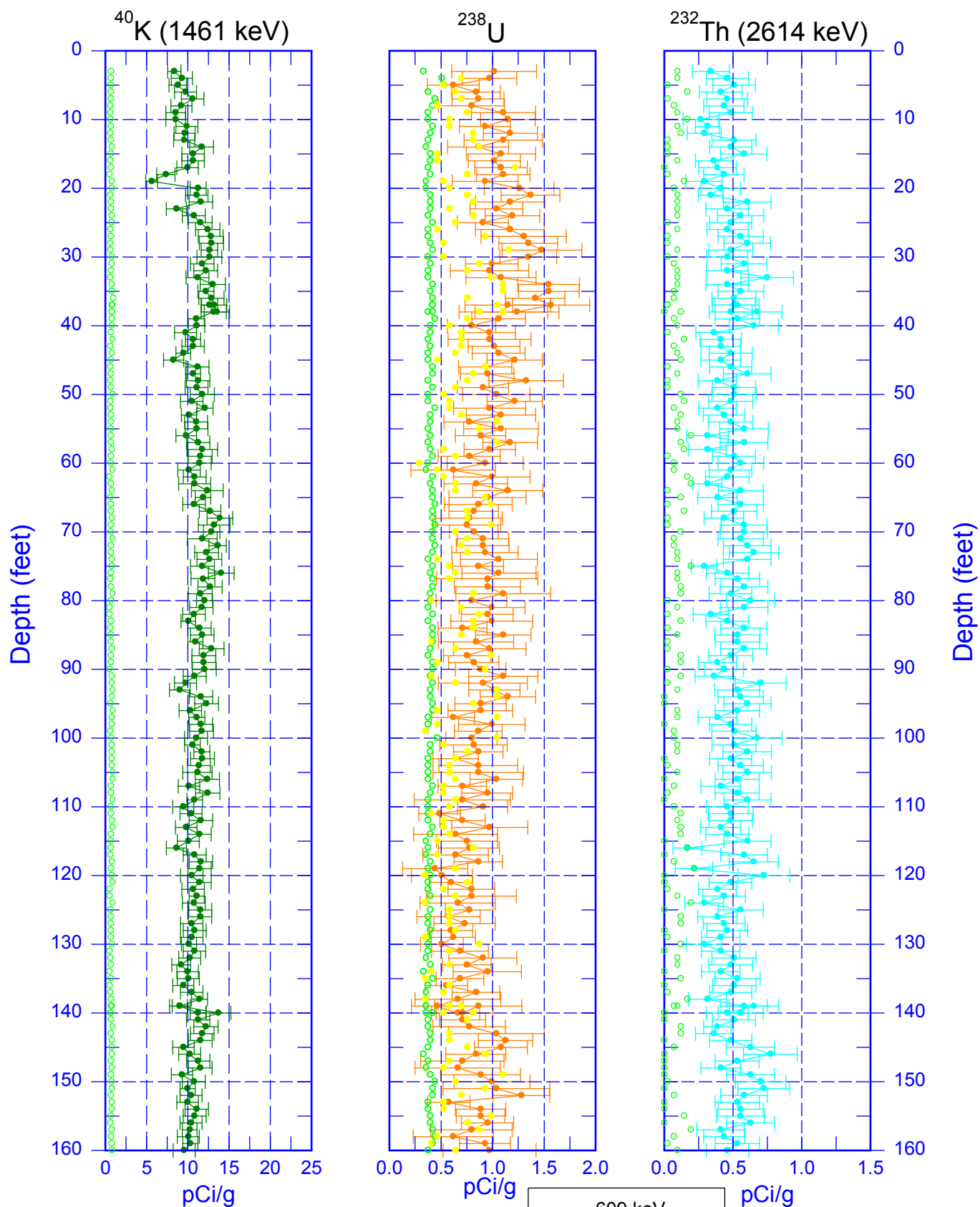
## Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run  
05/15/2002

# 299-E33-13 (A4840) Natural Gamma Logs

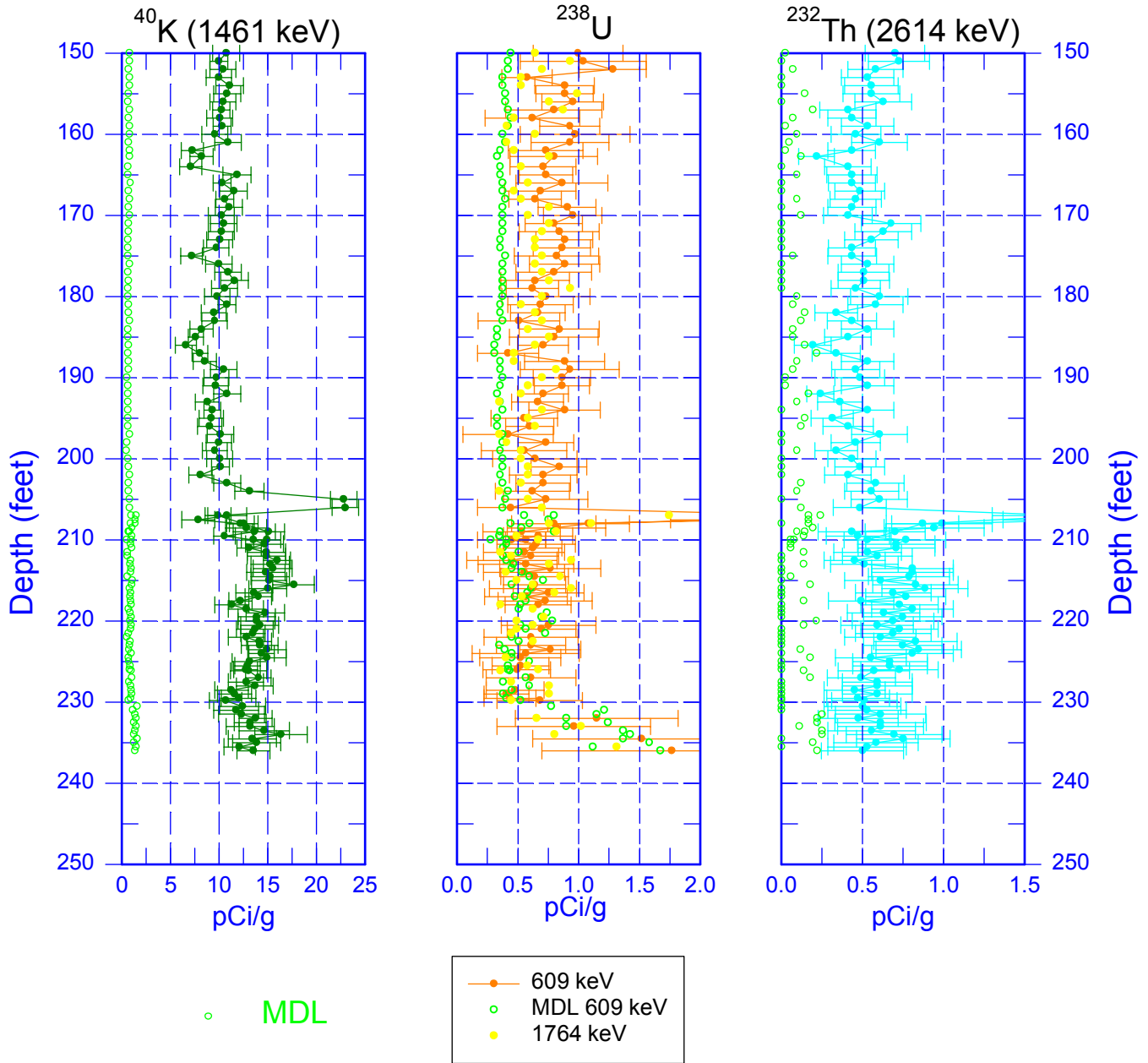


Zero Reference = Top of Casing

Date of Last Logging Run  
05/15/2002

# 299-E33-13 (A4840)

## Natural Gamma Logs

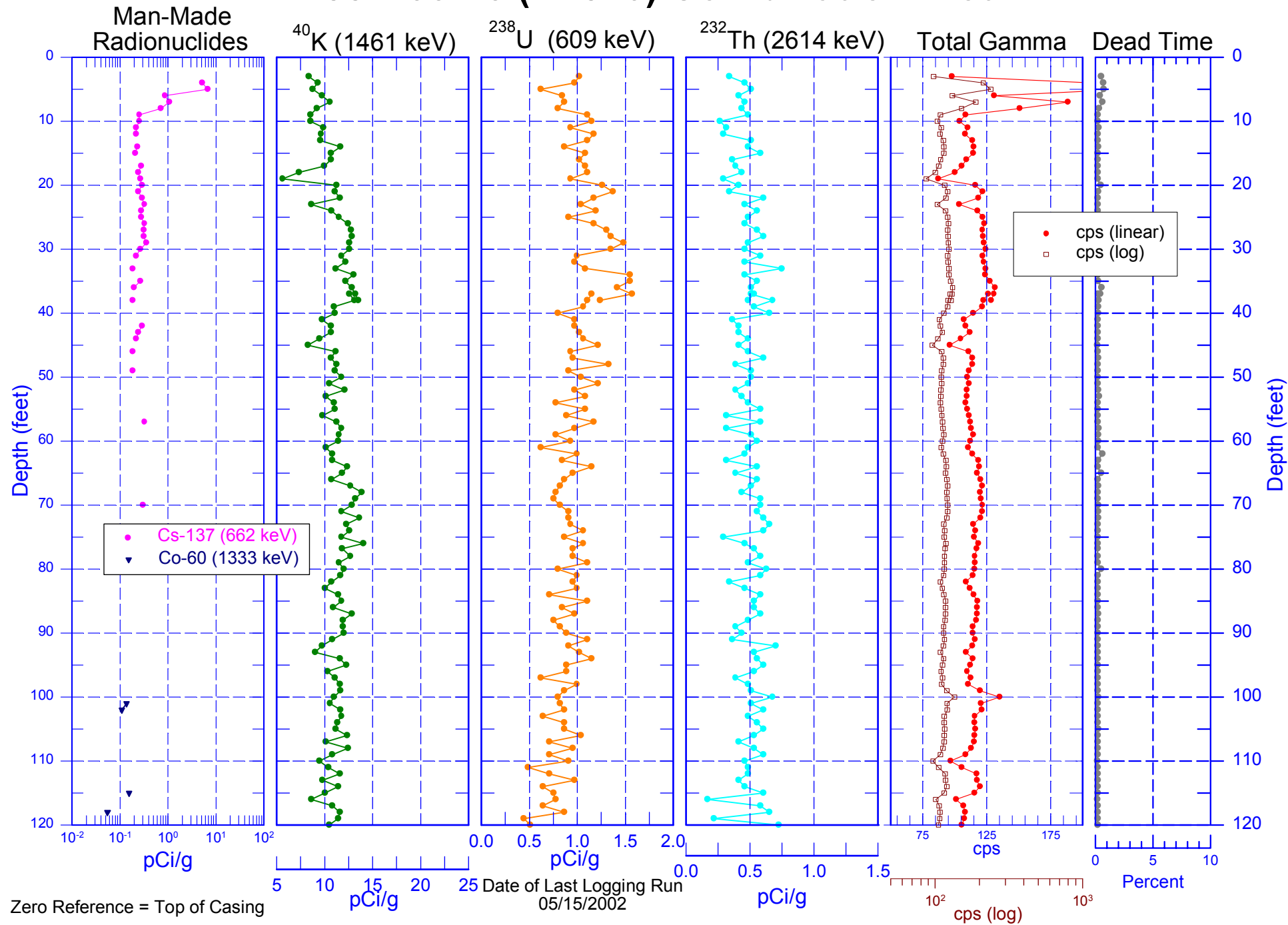


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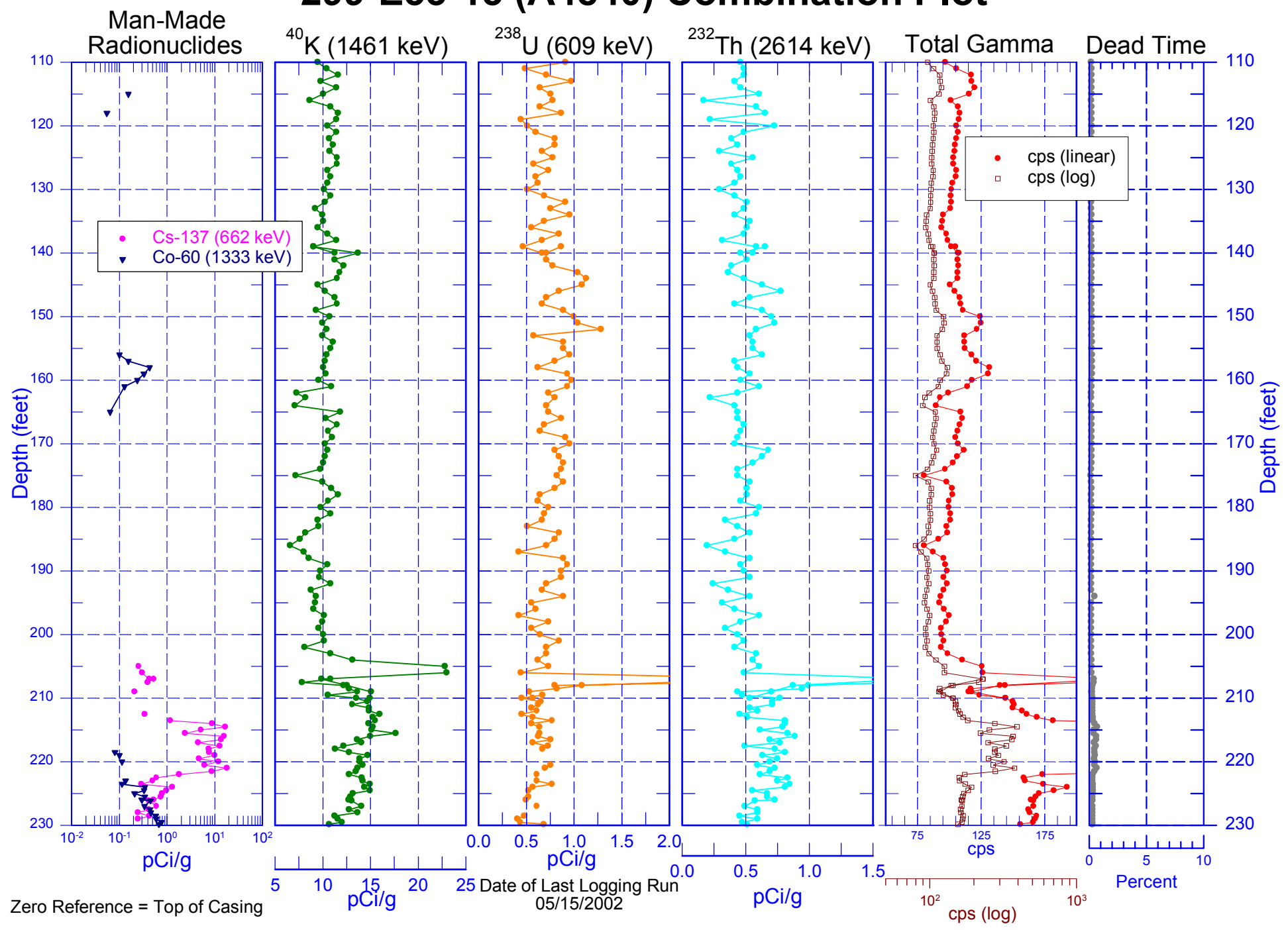
Date of Last Logging Run  
05/15/2002



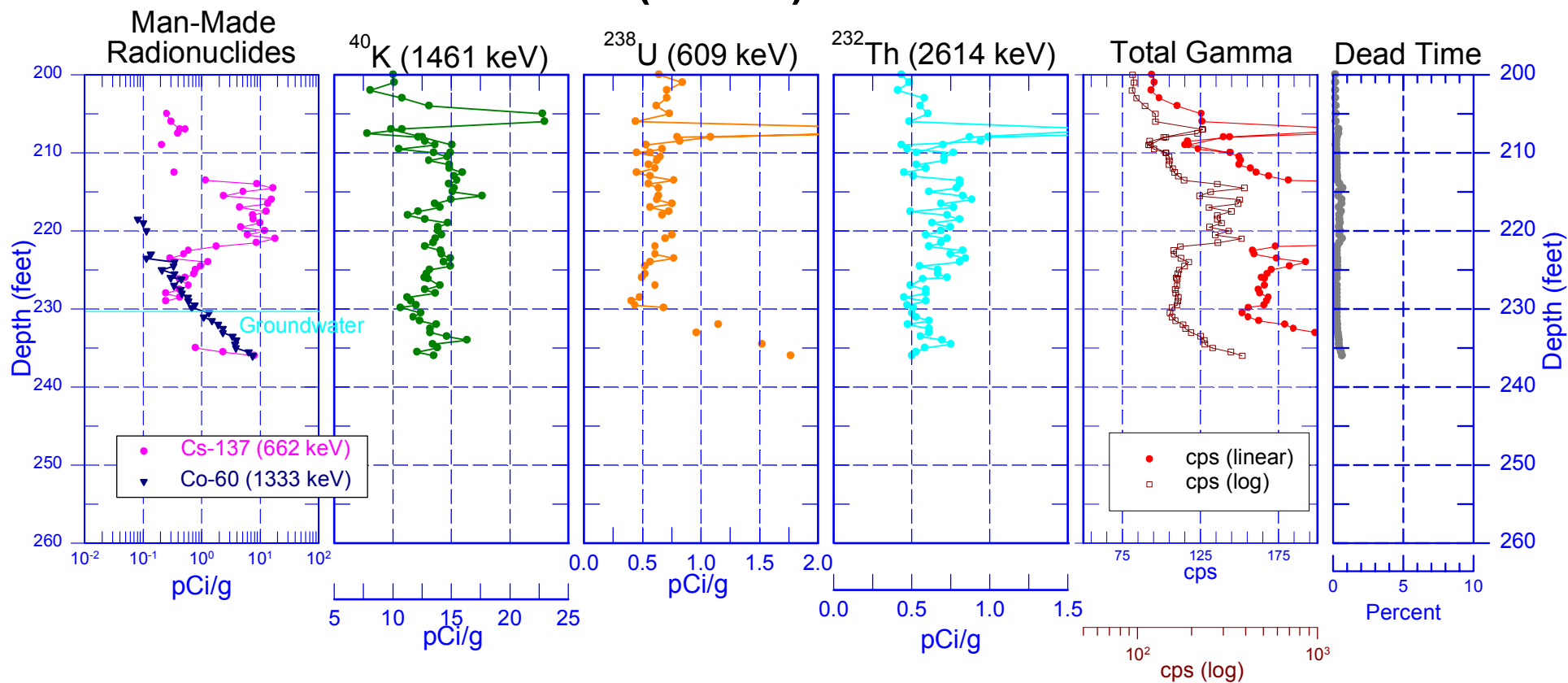
# 299-E33-13 (A4840) Combination Plot



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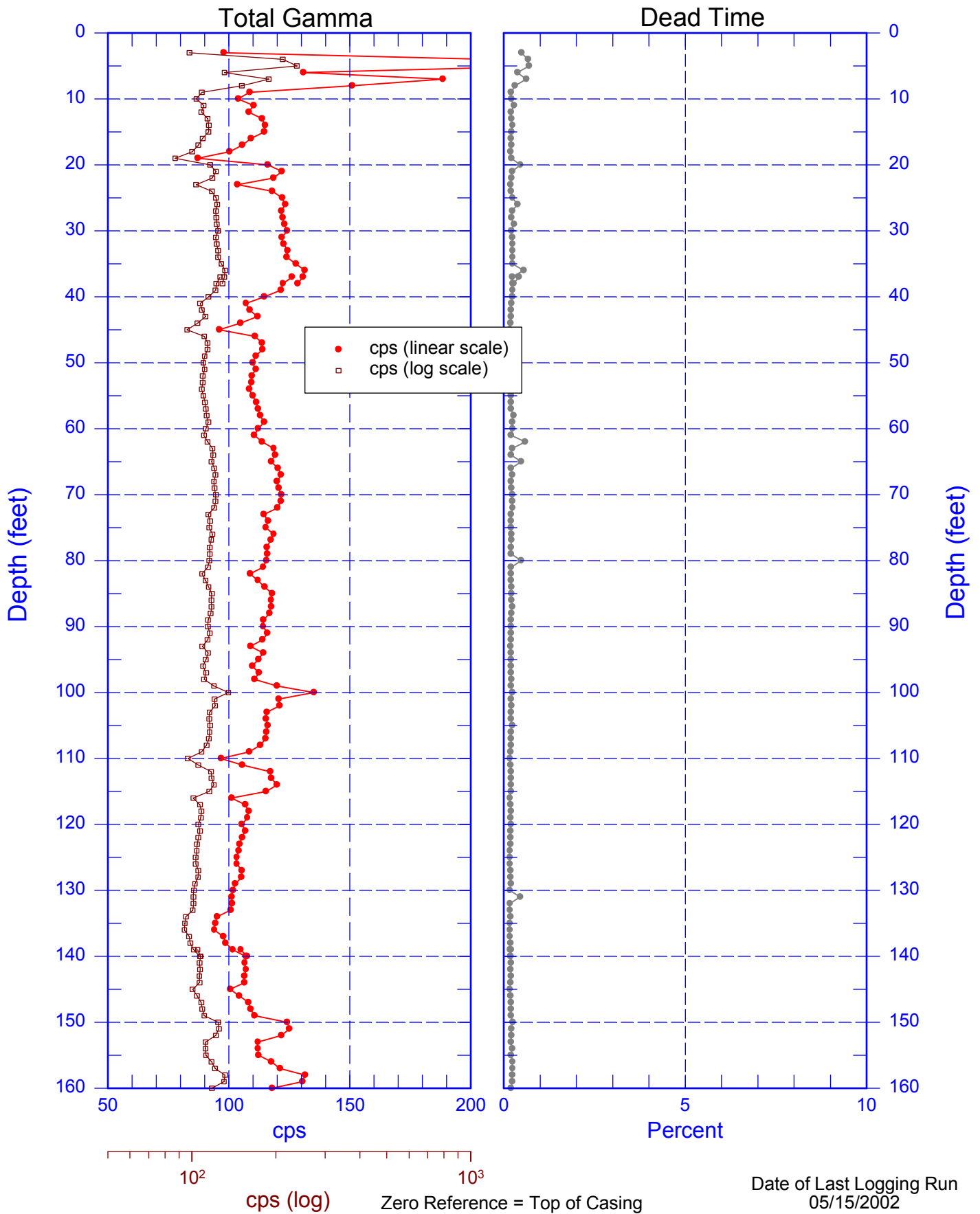


Zero Reference = Top of Casing

Date of Last Logging Run  
05/15/2002

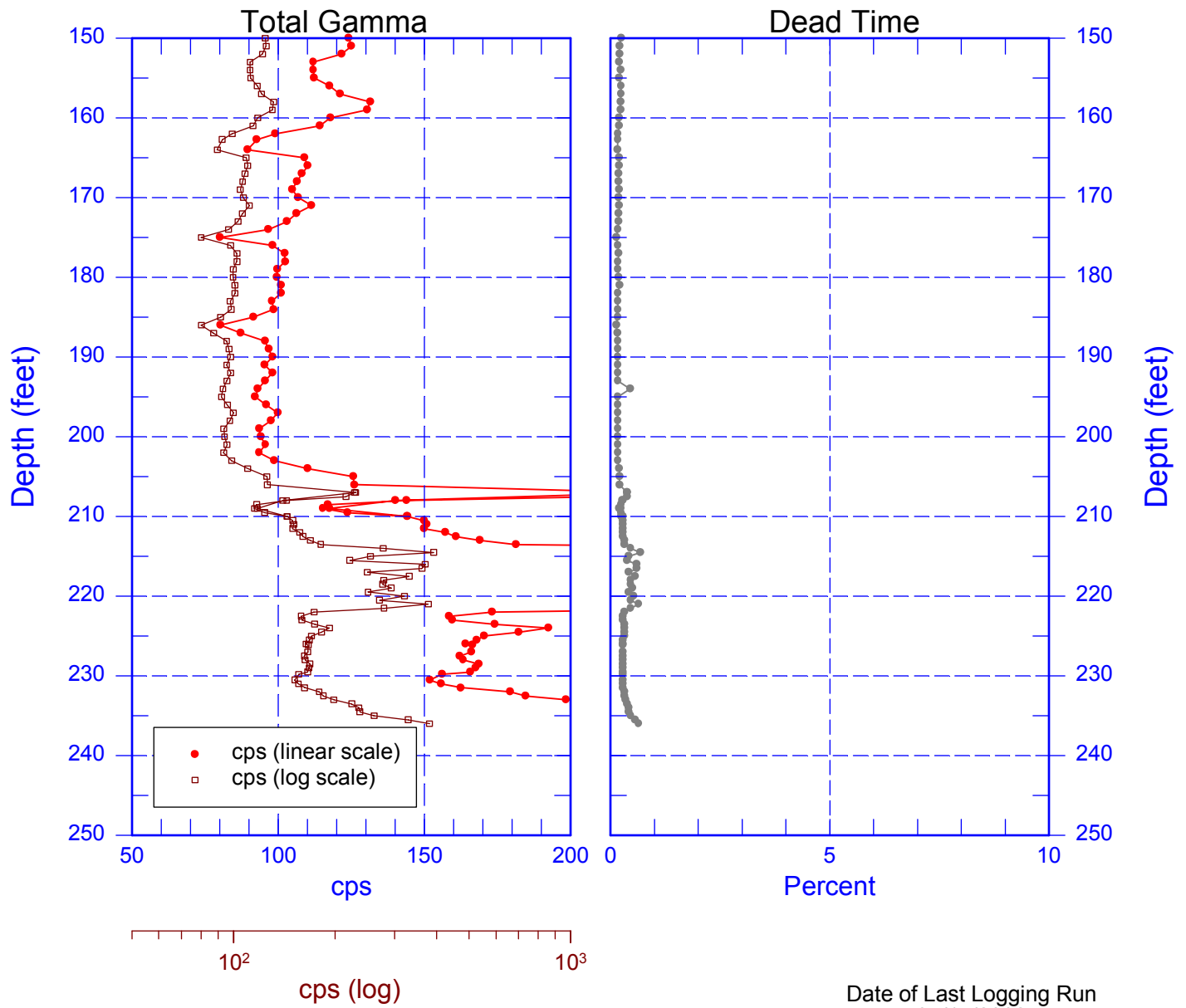
# 299-E33-13 (A4840)

## Total Gamma & Dead Time



# 299-E33-13 (A4840)

## Total Gamma & Dead Time

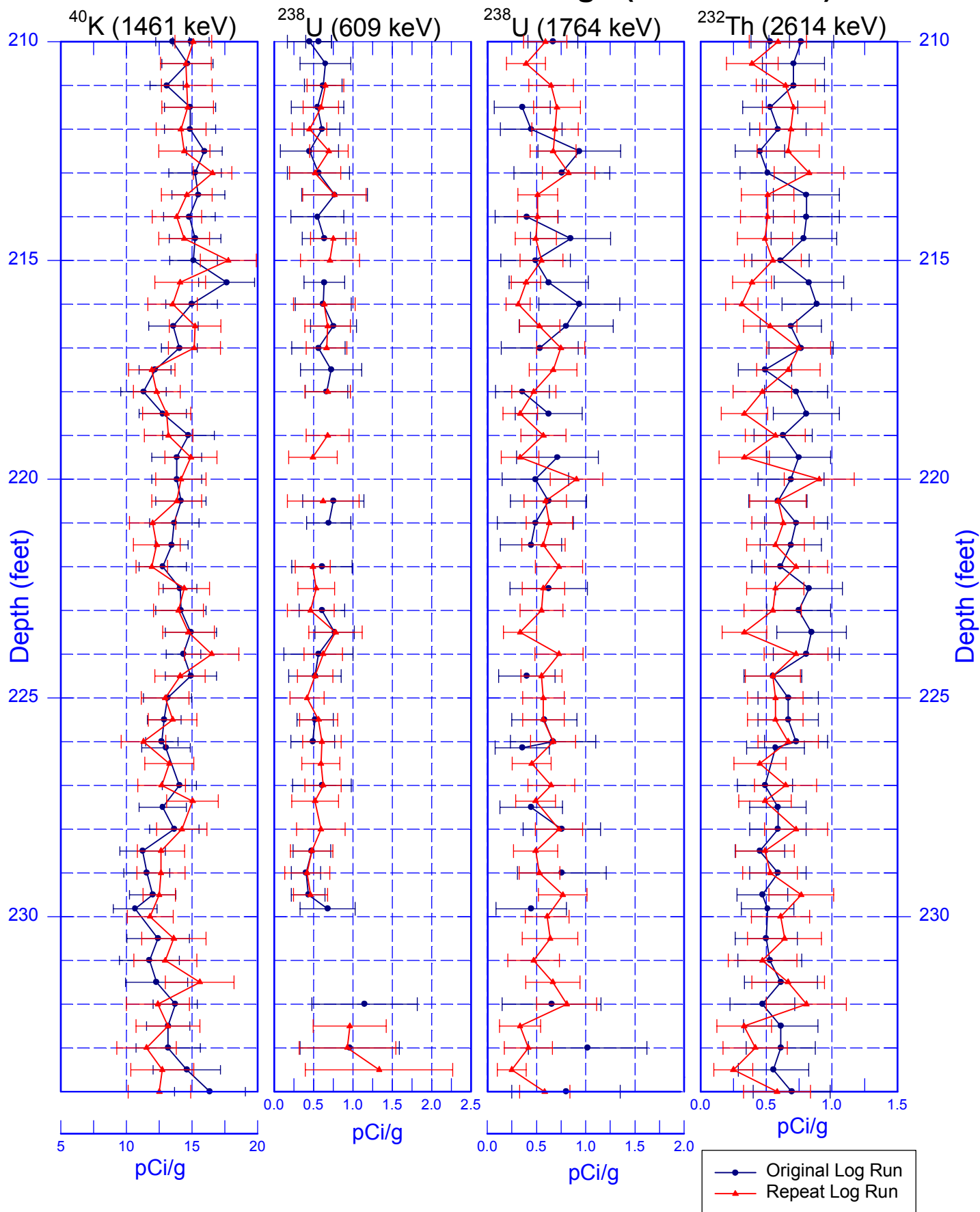


Date of Last Logging Run  
05/15/2002

Zero Reference = Top of Casing

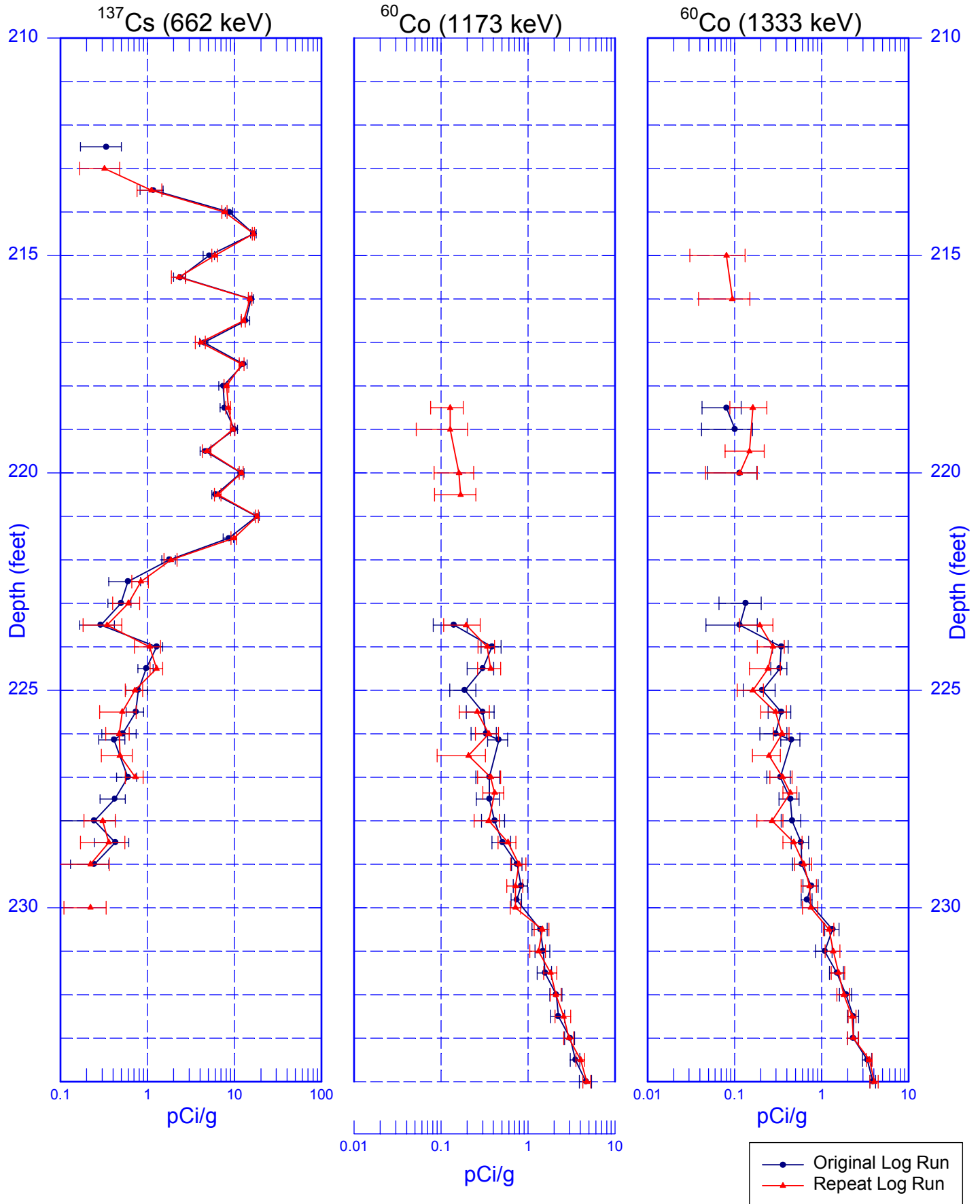
# 299-E33-13 (A4840)

## Rerun of Natural Gamma Logs (234 to 210 ft)



# 299-E33-13 (A4840)

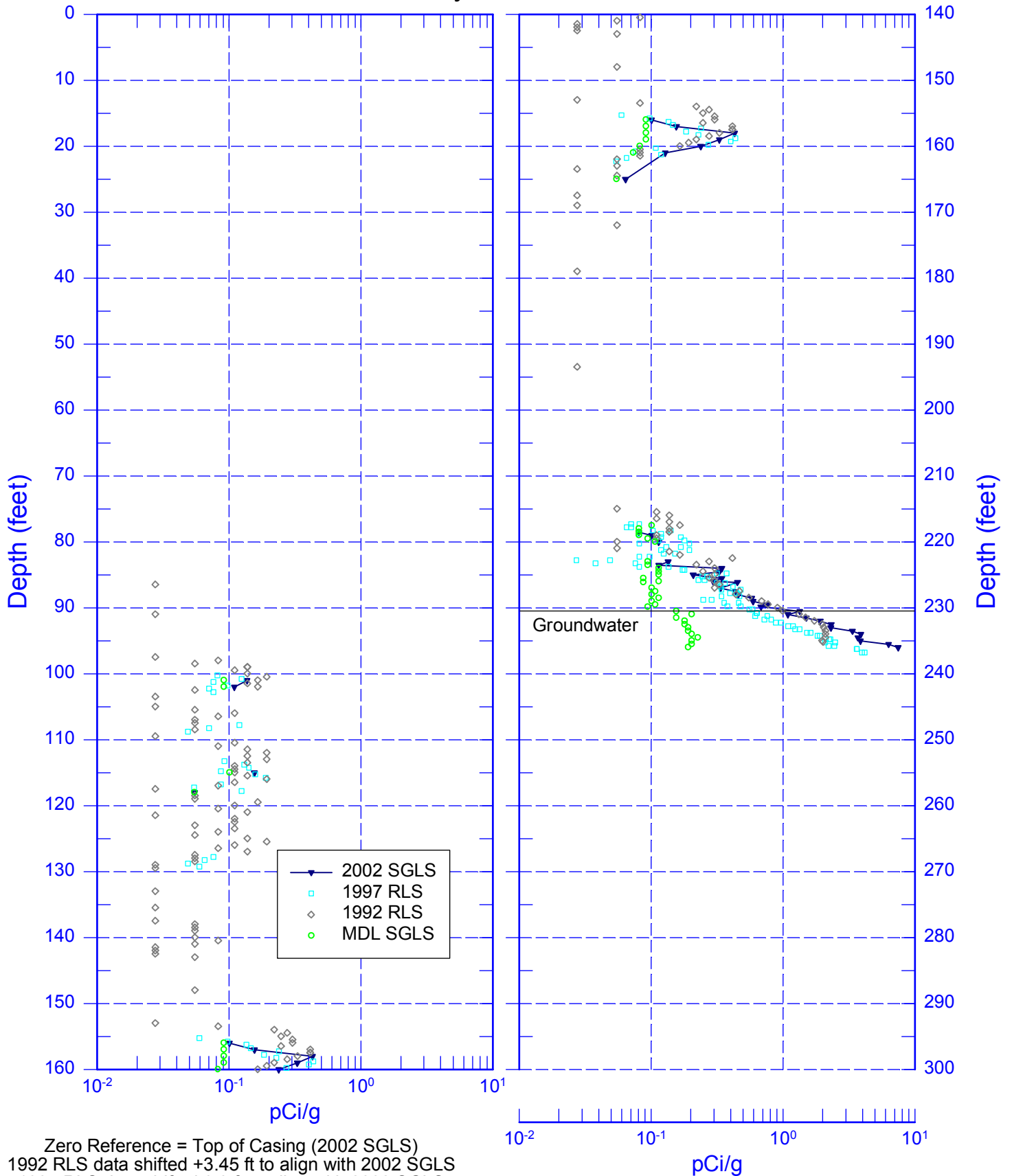
## Rerun of Man-Made Radionuclides (210 to 234 ft)



# 299-E33-13 (A4840)

RLS Data Compared to SGLS Data

$^{60}\text{Co}$  Decayed to 05/15/2002



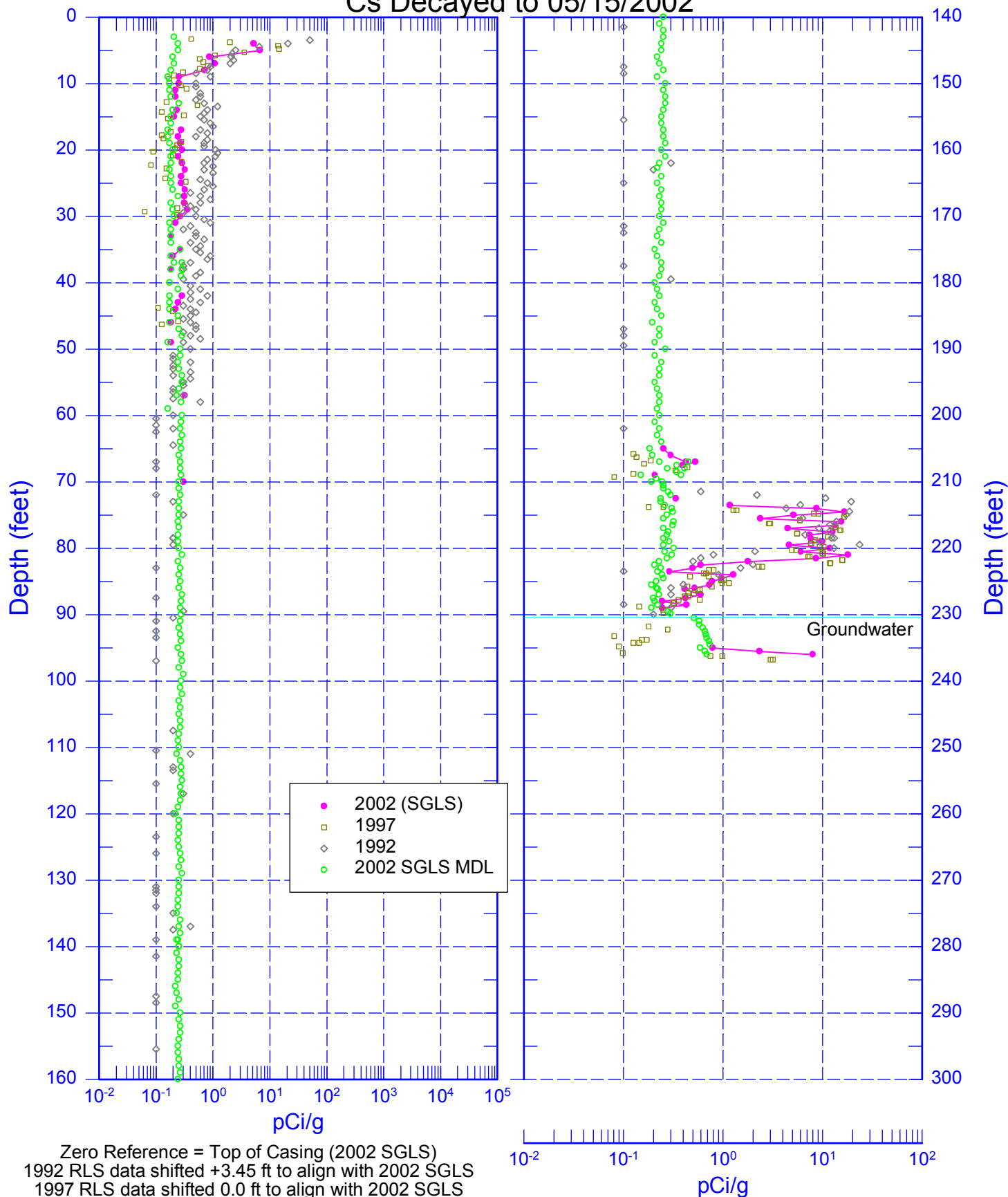
Zero Reference = Top of Casing (2002 SGLS)  
1992 RLS data shifted +3.45 ft to align with 2002 SGLS  
1997 RLS data shifted 0.0 ft to align with 2002 SGLS



# 299-E33-13 (A4840)

RLS Data Compared to SGLS & HRLS Data

<sup>137</sup>Cs Decayed to 05/15/2002



# 299-E33-13 (A4840)

## Total Gamma & Dead Time

